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NOTES, INFORMATION & NEWS

Arion hortensis Férussac, 1819, Species Complex in Delaware and Pennsylvania, Eastern USA (Gastropoda: Arionidae)

Timothy A. Pearce

Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213-4080, USA; PearceT@CarnegieMuseums.org

and

Elizabeth G. Bayne

Carnegie Museum of Natural History, 4400 Forbes Avenue, Pittsburgh, Pennsylvania 15213-4080, USA; egb1@pitt.edu

Introduction

Davies (1977) documented three distinct forms of what had previously been considered the single species *Arion hortensis* Férussac, 1819. Davies (1979) indicated that the three forms are *A. hortensis* Férussac, 1819, *A. distinctus* Mabille, 1868, and *A. owenii* Davies, 1979. Backeljau & van Beeck (1986) and Backeljau (1987) provided protein electrophoretic and scanning electron microscopy (SEM) evidence confirming that the three species are distinct. Although Davies (1977) and Barker (1999) have noted some external features that help to separate the species, identifications using external features seem unreliable. The most reliable feature for separating the species requires dissection. Within the genitalia, each species has a distinctly shaped and positioned verge where the epiphallus opens into the atrium (Davies, 1977; Backeljau & van Beeck, 1986; Barker, 1999).

European slugs in the *Arion hortensis* species complex were introduced to North America at least as long ago as 1842 (Binney, 1842). Although numerous records of "*Arion hortensis*" in North America have been reported since then (e.g., Dundee, 1974), it is not clear which of the three species in the complex are represented by records previous to the report of Davies (1977). Kaplan & Hartenstein (1977) reported *A. hortensis* from New York, but their paper had been submitted for publication in 1976 before Davies' paper (1977) was published, so it is unlikely that they were aware of the need to determine which member of the species complex they had found. Branson & Branson (1984) reported *A. hortensis* in Oregon but commented that the "diagnosis should be substantiated," suggesting that it is unlikely that they dissected the slugs to verify the identification.

Only two publications have documented which species in the complex occur in North America, Roth (1982) and Pearce & Blanchard (1992). The present paper reports two species of the *A. hortensis* species complex occurring in eastern North America, in the states of Delaware and Pennsylvania.

Methods

We examined slugs in the *Arion hortensis* species complex that were encountered during fieldwork from one locality in Delaware and three localities in Pennsylvania. We searched two museums, the Carnegie Museum of Natural History and the Delaware Museum of Natural History, for preserved specimens of the species complex collected before 1977 but we did not locate any specimens. Consequently, we were unable to verify which species of the complex formed the basis of pre-1977 literature records.

To determine which species in the *Arion hortensis* complex our specimens represented, we dissected them and examined the shape and position of the verge at the opening of the epiphallus within the atrium. The verge of *A. distinctus* is conical and covers the entire opening of the epiphallus, the verge of *A. hortensis* is a flaplike structure that does not completely fill the epiphallus, and the verge of *A. owenii* is a leaflike structure (Davies, 1977: 179, fig. 4; Backeljau & van Beeck, 1986:63–65, figs. 2–4; Barker, 1999:175–176, figs. 71,72). Furthermore, the spermatophores of the species differ, with those of *A. hortensis* having more strongly curved anterior and posterior ends and a more serrated longitudinal ridge than either of the other two species (Davies, 1977:178, fig. 2; Backeljau & van Beeck, 1986:63, fig. 2).

Results

We found *Arion hortensis s.s.* in Delaware, and both *A. distinctus* and *A. hortensis s.s.* in Pennsylvania.

Arion hortensis. **Delaware,** New Castle Co., Brandywine Creek State Park at Thompson Bridge, 8 km north of Wilmington, in stream drift, UTM 451800mE 4406600mN, 2 specimens collected by T. A. Pearce, 4 January 1997, Delaware Museum of Natural History (DMNH) number 207024 [both specimens dissected, a partly digested spermatophore found in one]; **Pennsylvania**, Allegheny Co., Pittsburgh, Phipps Conservatory, horticultural garden, UTM 589100mE 4476800mN, 4 specimens collected by T. A. Pearce and P. A. Robb, 25 April 2002, Carnegie Museum of Natural History (CMNH) number 64921 [one specimen dissected].

Arion distinctus. **Pennsylvania**, Allegheny Co., Pittsburgh, Highland Park, E side of Washington Boulevard along railroad tracks, UTM 592600mE 4482000mN, 13

specimens collected by T. A. Pearce, 3 and 15 April and 17 May 2002, CMNH 64920 [4 specimens dissected]; Allegheny Co., just N of Pittsburgh, North Park, SE side of N arm of North Park Lake, on moist wooded NE facing slope with red oak and some red maple, UTM 583600mE 4495300mN, 4 specimens, collected by T.A. Pearce, 5 April 2003, CMNH 65149 [one specimen dissected].

Discussion

In the *Arion hortensis* complex, two of the three species, *A. hortensis* and *A. distinctus,* have previously been reliably reported in North America from the San Francisco Bay Area, California in the western United States (Roth, 1982), and one species, *A. hortensis,* has been reliably reported from Ann Arbor, Michigan in the east-central United States (Pearce & Blanchard, 1992). The present study reports these species in the eastern United States with *A. hortensis* in the state of Delaware, and both *A. distinctus* and *A. hortensis* in the state of Pennsylvania.

Davies (1977) and Barker (1999) reported differences in external characters, particularly the banding pattern, that could be used in identifying *Arion distinctus* and *A. hortensis.* In *A. hortensis,* we found the right mantle band tended to be slightly raised above the pneumostome, although the specimens in alcohol were faded making it difficult to determine whether the right band was simply faded around the area of the pneumostome or was raised above its orifice. In *A. distinctus,* we found the pneumostome to be covered by the right band and the band had a small break in front of the pneumostome. Although these features were consistent with the external characters reported by Davies (1977) and Barker (1999), we did not feel confident using the band characteristics to separate species due to the close similarity between species, the variation within a species, and discoloration following preservation in alcohol. We consider examination of the epiphallus in the genitalia to be the most reliable feature for identifying species in this complex.

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